

## CILIO-SPINAL CENTRES.

By ISAAC OTT, M.D.

THE existence of cilio-spinal centres has been lately the subject of discussion. Budge's discoveries were first called in question by Salkowski, who believed that cilio-spinal centres did not exist, but that cilio-spinal fibres arose in the medulla oblongata or higher. François-Frank has, however, after the method of Budge shown that spinal centres influencing the movements of the iris exist. Luchsinger by means of sensory irritations has shown that cilio-spinal centres exist. Tuwim, however, has thrown doubt on these experiments of Luchsinger, stating that after section of the spinal cord sensory irritations did not dilate the pupil. I have made a number of experiments upon this subject. Method: Cats were chloroformed, bound down, the cord divided just below the medulla oblongata, and artificial respiration kept up by a respiration apparatus already described. After a rest of some time the sciatic was irritated by induction currents of a Du Bois apparatus, which was run by a Daniell cell. The external palpebral commissure was slit up, and the nictitating membrane and lower lid held away by weighted hooks. If now the sciatic was irritated the pupil was seen to dilate about two millimetres. When the cord centres were excited by another irritant acting on them through the blood, carbonic acid, then the pupil was also dilated. The cilio-spinal centres

may be demonstrated to exist, I think, in another manner. If in a cat the left cervical sympathetic is cut and the cord divided high up, then if no spinal centres acting on the iris existed, the diameters of the pupils should be equal, but experiment proves that the pupil with the sympathetic intact is more dilated than the other. Here some influence through the cervical sympathetic from the cord is acting. It might be objected that the tonic influence of the stellate ganglion, or fibres, still coming from the medulla oblongata caused the right pupil to be larger, but the left pupil was still under the influence of the superior cervical ganglion. I think that it is fair to draw the conclusion that the right pupil is kept larger by the influence of the cilio-spinal centres. I have also made experiments to determine the path of dilating fibres of the pupil by sensory irritation. When in a cat I had cut both cervical sympathetics, and the sciatic was irritated, the pupil was dilated. When the first thoracic and superior cervical sympathetic ganglia were extirpated and the sciatic irritated, the pupil still dilated. When the gray matter on the surface of one of the cerebral hemispheres had been broken up and the cervical sympathetic cut, then irritation of the sciatic dilated the pupil. When the gray matter of both cerebral hemispheres was broken up and both sympathetics in the neck divided, sensory irritation still dilated the pupil. When, however, the cerebrum was broken up down to the base of the brain and the cervical sympathetics cut, the sciatic irritation was powerless. These experiments lead to the conclusion that fibres dilating the iris run in the trigeminus, and that the seat of the dilation is here, and not in the seat of consciousness, as held by Schiff. The sympathetic ganglia also have an influence on the diameter of the pupil. François-Frank and Tuwim have made experiments upon this point. I have also exsected these ganglia. When in a cat the right first

thoracic ganglion is cut away from all spinal connection and the trunk of the sympathetic below it cut and the opposite sympathetic divided in the neck, then the right pupil will be found to be larger than the left. If now a section in the same animal experimented upon be made above the first thoracic ganglion, the diameter of the pupils will be the same. If the superio-cervical ganglion on the right side is extirpated, then the right pupil is smaller than the left. If in young cats the right superior cervical ganglion is extirpated and the left sympathetic below the ganglion divided, then when the animal is coming out of the chloroform the left pupil is at the time larger than the right, but shortly afterward it is smaller than the right, and remains so for several days. If atropia is given it does not change the result. These experiments demonstrate, that in the ganglia of the sympathetic resides a tonic influence for a short period over the pupil after they have no anatomical connection with the cilio-spinal centres in the spinal cord. I have already shown by experiments upon rabbits that after section of a lateral column the pupil on that side contracted, showing that cilio-spinal fibres run in these columns and that section removes part of the spinal influence on the pupil.